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Original Article

"RePlay Health": An Experiential Role-Playing Sport for Modeling Healthcare Decisions, Policies, and Outcomes

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Abstract

Objective: This article presents the design and empirical investigation of the ''RePlay Health'' game (www.replayhealth.com/), a novel ''role-playing sport'' derived from a complex, data-driven, computational simulation of healthcare dynamics. By immersing players in a fictional world in which they take on the role of characters facing specific behavioral and environmental risk factors, the ''RePlay Health'' game models the impact of health and healthcare policy on individual-level livelihood and community-level productivity.
Subjects and Methods: A randomized experiment tested the efficacy of the game for inspiring shifts in thinking about public health and healthcare policy. This study compared the impact of actively playing the game versus passively spectating: 31 young adults were assigned to one of these two roles. Participants completed pretest and posttest measures of their subjective ranking of healthcare policies and attributions for health outcomes.
Results: Active players (compared with spectators) reported significantly higher prioritizations (from pretest to posttest) in their subjective ranking of several health policies modeled by the game, such as ''improving postdischarge care'' and ''increasing access to healthy foods.'' Furthermore, players, but not spectators, were significantly more likely following gameplay to identify environmental or systemic factors as potential causes of health problems.
Conclusions: The fact that significant results emerged with a 1-week gap between gameplay and measurement demonstrates that the game could exert a lasting impact on attitudes and perceptions. More broadly, this work illustrates the value of incorporating experiential components, such as narrative, embodiment, and role-playing, in designing efficacious games for health.

Introduction

There is increasing evidence that games can serve as effective interventions to educate players about important health issues and to instill habits and mindsets conducive to personal health and well-being. To cite one particularly illuminating example, Kato et al.[1] found that playing the videogame ''Re-Mission,'' a ''third-person shooter'' in which players travel inside the bodies of cancer patients to destroy cancer cells, significantly increased adherence to treatment plans and promoted a host of positive behavioral outcomes among adolescent patients diagnosed with malignancies.[2] Furthermore, recent meta-analyses have revealed that a majority of videogames featuring pro-health content stimulated significant changes in pro-health attitudes and behaviors.[3] The present work aimed:

1. To extend the growing body of work in the ''games for health'' domain to the realm of healthcare delivery by demonstrating that a game could also produce measurable shifts in players' prioritization of health policy initiatives and instill a keener appreciation for the impact of external, systemic factors on personal health outcomes;
2. To invent an embodied method for effective play that distills the complexity of computational simulations to create an accessible, impactful experience of healthcare dynamics;
3. To establish empirically the importance of *playing* a game as an active participant, versus merely *watching* a game as a passive spectator, for triggering significant changes to individuals' attitudes and perceptions.

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Specifically, this article outlines the design of the ''RePlay Health'' game (www.replayhealth.com/) and an initial study testing its efficacy. ''RePlay Health'' is the first ''role-playing sport'' invented to model the impact of both behavioral/environmental health risk factors and public health initiatives on health outcomes. We present the results of a randomized, controlled study providing initial evidence for the effectiveness of the game at changing several key health-related attitudes and beliefs modeled by the game.

Background and overview

Game conception and goals. The impetus behind the ''RePlay Health'' game was to translate an existing computer simulation, ''ReThink Health Dynamics,'' into a playable and accessible game experience. The ''ReThink Health Dynamics'' model incorporates real-world data from cities across the United States to allow participants to pose specific healthcare-related and community-oriented questions with their choices of input variables (e.g., the implementation of campaigns to cut the number of hospital-acquired infections) and to learn the projected impact those decisions have on community-wide health costs and outcomes (Fig. 1). Simulations like ''ReThink Health Dynamics'' are being increasingly used by a variety of stakeholders who recognize their value for modeling and assessing the multifaceted challenges inherent in modern healthcare delivery.[4,5]

The ''RePlay Health'' project was started as a collaboration among the team at Dartmouth College's Tiltfactor game design and research laboratory (Hanover, NH), the creators of the ''ReThink Health'' simulation, and an interdisciplinary group of public health and innovation experts. In the design approach to translating the complex computer simulation to an engaging physical play format, the team immediately recognized the need to trade the simulation's quantitative accuracy for the benefits of an immersive, experiential game. Thus, the first design decision was to convert the simulation into a playable experience that would allow for uncertainty, risky experimentation, and failure in ways that the formal computerized simulation does not. The second aim was to make the playable experience more widely available and accessible to a more diverse audience than the computer simulation. The simulation is typically run with specialized software by a trained facilitator in limited-person, scheduled workshops. In contrast, the game setup was intended to be short, easy to learn, and able to be played with easily accessible materials (i.e., using printable materials and common, everyday objects), without requiring any special training or prerequisite knowledge of the intricacies of public health policy or health statistics.

In brief, the ''RePlay Health'' game allows players to experience and to navigate public health challenges in the U.S. healthcare system both as patients and as voters who can implement policy changes via referenda. Players enact the roles of specific citizens of a fictional town, and the game immerses them in a real-time narrative in which they must make a variety of individual and collective decisions that impact their own and others' health. Further details of the game and its narrative are provided in Table 1 and in the game overview section (Fig. 2 shows sample game materials).

Theoretical foundation. The psychology of narratives and narrative-based evidence. The decision to make the ''RePlay Health'' game a narrative-rich, character-driven role-playing game was guided in part by psychological

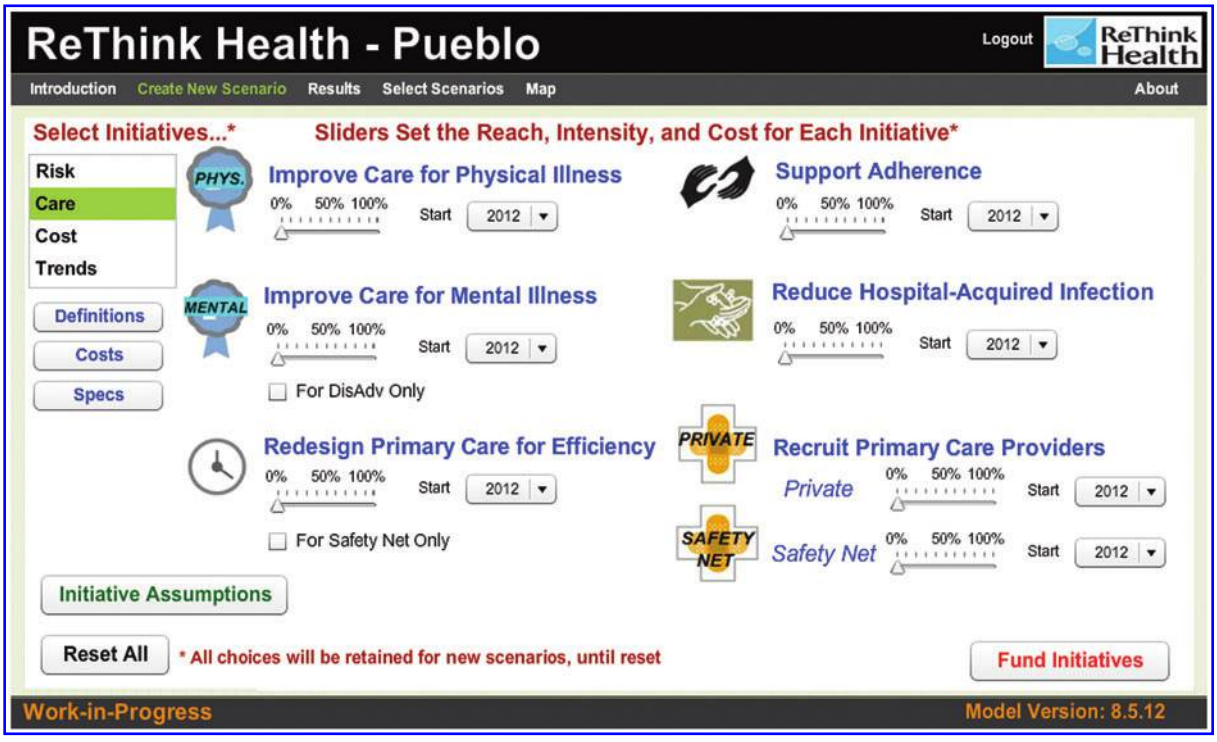

FIG. 1. Sample screenshot from ''ReThink Health Dynamics'' simulation. Color images available online at www.liebertonline.com/g4h

Table 1. Characteristics of a Nondigital Game for Health: "RePlay Health"

Characteristic	*Description*
Health topic(s)	Public health policy, external and systemic health risk factors, impact of health detriments on personal and community-wide livelihood
Targeted age group(s)	14 years of age to adult
Other targeted group characteristics	No prior health policy or public health background or knowledge is required for play. The game is appropriate for all age groups, from youth to adult.
Short description of game idea	"RePlay Health" is a live-action "role-playing sport" derived from "ReThink Health Dynamics," a complex, data-driven, computational simulation of the impact of healthcare policy initiatives. The game converts a subset of the simulation's input and outcome variables into a simplified, playable experience. The game allows players to experience and to navigate public health challenges in the U.S. healthcare system both as patients and as voters who can implement policy changes via referenda.
Target player(s)	Small group
Guiding knowledge or behavior change theory(ies), models, or conceptual framework(s)	Narrative transportation[7]; experience-taking with narrative characters[6]; perspective-taking[12]
Intended health behavior changes	Shift in prioritization and valuation of health policy reforms modeled by game; increased recognition of impact of systemic and environmental risk factors on detrimental health behaviors and outcomes
Knowledge element(s) to be learned	Increased understanding of specific health policy issues and options (e.g., shared decision-making; capturing of shared savings; universal health insurance)
Behavior change procedure(s) (taken from Michie inventory) or therapeutic procedure(s) used	NA
Clinical or parental support needed? (please specify)	NA
Data shared with parent or clinician	NA
Type of game	Active; role-playing; sports
Story (if any)	
Synopsis (including story arc)	Players enact the roles of specific citizens of a fictional town. The game's loose narrative unfolds in a series of rounds during which players must balance the goal of improving their own character's livelihood (by scoring points in a series of bean-bag tosses) and addressing personal health declines (by sitting out tosses to seek medical care). Between rounds, players collectively vote on and enact policy changes.
How the story relates to targeted behavior change	Each character is given a unique profile of personal and environmental health risk factors, which pose a threat to his or her well-being throughout the game; this element aims to increase awareness of the effects of health risks on personal livelihood. The group policy referenda aim to model the policy decision-making process and to exhibit the efficacy of various policy reform options.
Game components	
Setting (describe)	The game is designed to be played in a variety of public settings (including classrooms, conferences, and public spaces).
Avatar	
Characteristics	Unique ID photos, professions, interests, health risk factors
Abilities	A character's possession of insurance coverage determines his or her care-seeking options.
Game platform(s) needed to play the game	NA (nondigital)
Sensors used	NA
Estimated play time	45–60 minutes

NA, not applicable.

FIG. 2. Sample ''RePlay Health'' game materials. Color images available online at www.liebertonline.com/g4h

research demonstrating the transformative impact of fictional narratives—and identification with the characters who inhabit fictional worlds. Playing a central role in this regard is the phenomenon of ''experience-taking,'' which refers to the spontaneous process of assuming the identity of a character in a fictional narrative and simulating that character's subjective experience (e.g., the character's thoughts, emotions, behaviors, goals, and traits) while immersed in the world of the story.[6–9] This research has shown how fictional and simulated worlds give individuals the chance to take on different identities and, as a result, dramatically affect the beliefs and behaviors of readers once they emerge from the narrative world. Related work has shown that the use of narratives to guide perspective-taking—by inviting individuals to step into the proverbial shoes of a character—can likewise yield a sweeping array of beneficial effects. These effects include increased empathy[10] and altruism,[11] greater overlap in mental representations of self and other,[12] and, importantly, greater appreciation for the impact of situational and ecological factors on personal behaviors and outcomes.[13]

Furthermore, there is ample evidence to suggest that compelling personal narratives can be incorporated successfully in the design of interventions to affect health-related decision-making. For example, personal narratives have proven effective at changing perceptions and mindsets at a personal level, with topics such as end-of-life care,[14] as well as to inspire attitude shifts at a policy level.[15–17] Moreover, a vast body of work in psychology has demonstrated that information is often more easily processed and recalled (and, thus, more persuasive) when it is presented in narrativized form as opposed to statistical abstraction[18–21] (however, see Kopfman et al.[22] for evidence of the persuasive parity of anecdotal and statistical presentations of information about the importance of organ donation). Thus, the predicted efficacy of the ''RePlay Health'' game depended on creating a transporting, absorbing game experience that would foster high levels of ''experience-taking'' with characters who experience firsthand the effects of public health policy decisions and the impact of systemic factors on health-related behaviors and outcomes.

"RePlay Health" gameplay. The ''RePlay Health'' game begins with the group of players receiving unique ''identity cards.'' Each card presents a set of characteristics and needs particular to that character's persona, as well as a color-coded scale representing their current health status (Fig. 3). (All printable materials and instructions for the ''RePlay Health'' game are available to be downloaded and printed free of charge on the game's Web site [www.replayhealth.com/].) All players begin the game in good health. During the course of play, however, players eventually confront the reality of declining health, the extent of which is governed by their character's specific biographical profile (e.g., the tendency to engage in risky behaviors, such as smoking, or repeated exposure to environmental risk factors, such as air pollution).

The sport mechanic in ''RePlay Health'' uses a simple, repeated bean-bag toss: Several times during each round, players are challenged to throw bean bags at targets on the ground to score points, with further and smaller targets being worth a higher number of points. These rounds represent facets of ''everyday life,'' such as the repeated action

FIG. 3. Identity card from the ''RePlay Health'' game. Color images available online at www.liebertonline.com/g4h

of going to work or the engaged effort to be a productive member of society. Just as one in poor health experiences low quality of life in day-to-day functions, a ''RePlay Health'' player, should he or she become ill, must toss the bean bag from a line further away from the targets. The distance metaphor is intended to help players conceptualize how poor health can act as a barrier to achieving one's individual life goals.

''RePlay Health'' game sessions are run by one player who serves as the moderator. Following each bag toss, the moderator ''announces'' that specific risk factors (drawn randomly from a set of announcement cards) have caused declining health for those players whose identity cards contain them (Fig. 4). Players who experience these declines are confronted with a core choice: Do they want to ''stay in the game'' as they become more ill, or do they sit out a toss and visit one of two Healthcare Provider stations? In this fictional healthcare system, players sit out a requisite number of tosses and then numerically increase their health status by a specified number of levels.

FIG. 4. Sample announcement card from the ''RePlay Health'' game. Color images available online at www.liebertonline.com/g4h

In between rounds, players reconfigure in a lightning round as ''healthcare policy makers'' and create new strategies, or ''initiatives,'' to try and improve their individual and collective health. At this time patients gather together, debate, and vote on which of many ''initiatives'' they wish to implement for the next round (Fig. 5). Initiatives represent either new policies or new infrastructural elements for the fictional community, each with the potential to alter the game rules in favor of the players (the full list is given in Table 2). In subsequent rounds, players experience firsthand the impact of their policy decisions on their own—and other players'—ability to succeed in the game.

The iterative design of the game was directly informed by a series of play tests with a variety of playgroup participants (including a broad range of testers, from youth to adult, with widely varying levels of knowledge and expertise about public health and health policy). A primary goal of user testing was to identify elements of the game that increased players' level of experience-taking with their assigned characters as well as elements that could be added to the game to enhance players' connection to their characters and sense of agency as actors in the game. This process led to the abandonment of some early game design choices (such as the assigning of players to *either* patient or care provider roles, after discovering players reported low levels of immersion and experience-taking in the latter) and the enhancement of other game features (most notably the increased level of detail in players' identification cards and the addition of character photographs to facilitate role-playing in the game).

In order to provide evidence of the game's impact on players, a pilot study was conducted to assess the effects of active gameplay on players' subjective ranking of health policies and appreciation for the role of situational or

FIG. 5. Players voting on policy initiatives during a gameplay session. Color images available online at www.liebertonline.com/g4h

systemic factors as contributors to unhealthy behaviors. This study used a fully randomized, pretest/posttest design to track changes on these key outcomes exhibited by participants assigned to experience the game as either active players or passive spectators. Because the efficacy of the game rests on players' active engagement with their game character's identities, decisions, and outcomes (i.e., immersive role-playing and experience-taking), it was predicted that the game's impact would be significantly greater among active players (compared with peers exposed to the same information and gameplay dynamics as observers of the game). Prior work on the health game ''Re-Mission'' provides additional justification for this study design: The effects of the game on activating the brain's positive motivation circuits, a key contributor to the game's impact on players' attitudes and behavior, were exhibited by active players of the game, but not by other players who passively observed the same gameplay events.[23] Specifically, we believed that active participation in the game would increase the impact on two key game elements—the firsthand experience of the deleterious impact of environmental health risk factors and the positive (or negative) impact of selected and implemented health policy initiatives—on players' identification of systemic and external variables to explain health behaviors and outcomes and players' prioritizations of policy initiatives modeled by the game, as shown in Table 3.

Table 2. Policy Initiatives Included in the ''RePlay Health'' Game

Initiative	*Description*
Create new parks and walking paths	Make exercising more accessible. All players exercise regularly and no longer lose health due to sedentary lifestyles.
Pass a tobacco tax	There is a new tax on tobacco sales in town. Many inhabitants quit smoking, so players no longer lose health due to smoking or polluted air.
Start a local farmer's market	New local farmers' markets are opened in town. All players now eat a healthy diet and don't lose health due to unhealthy diet.
Implement shared decision-making	Increase communication between doctors and patients. If players visit primary care, they may peek at three tabs and then tear off one of them.
Deploy community health workers	Place the Community Health Workers signs next to the tossing lines. This station has a chance to decrease risk and takes one toss to visit.
Recruit more primary care physicians	Double the number of primary care physicians in town. Place the extra sign(s) next to the current one. Double the number of people can now go there at once!
Enact universal health insurance	Everyone is now insured. Players may visit any care station regardless of insurance status.
Capture shared savings	Following each round, if all players have green or yellow health, choose an additional initiative to implement. If any player has red health, implement no initiatives instead of one.
Make postdischarge care safer	After visiting the ''Emergency Department,'' players may immediately visit ''Primary Care'' and take a tab with no additional wait.

Table 3. Proposed Path from Game Elements to Predicted Outcomes for the "RePlay Health" Game

Game element		*Psychological mechanism*		*Predicted outcome*
Firsthand experience of the negative impact of systemic and external risk factors on health outcomes	→	Increased cognitive accessibility and rates of attribution of external variables to explain unhealthy behaviors and outcomes	→	Higher levels of concern and action for health policy reform centered on systemic changes
Active engagement with voting on—and experiencing the effects of—health policy reform referenda	→	Shifts in prioritization of specific health reform policies modeled by and enacted in the game	→	Corresponding changes in real-life action, such as voting for policies (and policymakers) that align with new prioritizations

Subjects and Methods

Participants

A sample of 31 young adults (21 female, 10 male; mean age, 22.45 years; age range, 18–35 years), the majority of whom were medical students or undergraduate premedical students, was recruited, via e-mail invitations and word of mouth, to participate in the study (see Table 4 for a full description of participant characteristics). All materials and procedures for the study were approved by the Institutional Review Board and Committee for the Protection of Human Subjects at the authors' institution prior to the start of data collection. In addition, all participants provided their written consent to take part in the study.

Materials and procedure

Pretest measurement. All participants completed an online pretest questionnaire 2 weeks prior to the gameplay session. In addition to a set of demographics variables (including gender, age, and area of study), this questionnaire contained two focal measures of variables anticipated to be impacted by the game: (1) players' subjective ranking of a set of policy initiatives and (2) their identification of external (i.e., situational or systemic) factors as contributors to poor personal health behaviors and outcomes. The first measure presented participants with a name and brief description of 14 different public health initiatives—including those presented in the game (e.g., setting up community health workers, implementing shared decision-making, creating parks and walking paths) as well as ones not represented in the game (e.g., creating medical homes, reforming medical malpractice adjudication processes)—and instructed participants to order them from 1 (most effective at improving public health) to 14 (least effective at improving public health) based on their subjective assessment of their efficacy.

For the second measure, participants were given a set of hypothetical negative outcomes or behaviors exhibited by an individual—two health-related ("Chris eats fast food for lunch every day" and "Jamie has lung cancer") and two non–health-related ("Pat was laid off" and "Terry was in a car accident")—and were asked, via open-ended responses, to identify, in order of likelihood, the three factors that may have contributed to these scenarios. The three factors identified by participants would later be coded for their attribution of each event to either personal (i.e., dispositional) or external (i.e., situational or systemic) variables.

Table 4. Description of Participants

	Experimental condition		
	Active player group (n = 16)	*Passive observer group (n = 15)*	*Total (n = 31)*
Gender			
Male	5 (31)	5 (33)	10 (32)
Female	11 (69)	10 (67)	21 (68)
Age (years)			
18–20	6 (37)	7 (47)	13 (42)
21–24	7 (44)	5 (33)	12 (39)
25–35	3 (19)	3 (20)	6 (19)
Race			
White	12 (75)	12 (80)	24 (78)
Asian	2 (13)	1 (7)	3 (10)
African American	1 (6)	1 (7)	2 (6)
Latino(a)	1 (6)	1 (7)	2 (6)
Area of study			
Medical school	6 (38)	4 (27)	10 (32)
Premedical	2 (12)	2 (13)	4 (13)
Medical (other)	4 (25)	4 (27)	8 (26)
Nonmedical	4 (25)	5 (33)	9 (29)

Data are number of participants (percent).

Gameplay session. Participants took part in a full "RePlay Health" game session in groups of 10–12 players. Prior to the session, all participants were randomly assigned (using the online random number generator and randomizer tool at www.randomizer.org) to one of two conditions representing the two player types for the study: (1) active players or (2) passive spectators. All participants were given identity cards upon arrival for the session; however, whereas the active players would take part in all of the gameplay activities, the passive spectators were assigned roles (e.g., "newscasters," who read each round's risk factor announcements, or "bankers," who compensated players for successful bean-bag tosses) that positioned them as witnesses to the game's unfolding events. Research assistants served as moderators for the game.

Posttest measurement. In the week following the gameplay session, all participants completed a second online questionnaire that contained versions of the two focal

outcome measures (i.e., the policy ranking and health outcome attribution measures) that altered the order of presentation of their items from the order used in the pretest questionnaire. In addition, the posttest questionnaire included single-item Likert scale measures of participants' enjoyment of the game, anchored at 1 (not at all enjoyable) and 7 (extremely enjoyable), and the degree to which the game held their attention, anchored at 1 (my mind wandered most of the time) and 7 (my mind was always on the game). These items were included to help rule out the possibility than any differential impact of the game on active players versus passive spectators could be due solely to a difference in positive affect or cognitive engagement elicited by the two groups' assigned roles in the game.

Results

Game enjoyment and player attention

All study variables and accompanying descriptive statistics are provided in Table 5. A one-way analysis of variance revealed that although active players' average rated enjoyment of the game (mean = 5.11, standard deviation [SD] = 1.18) was higher than the average enjoyment reported by passive spectators (mean = 4.69, SD = 1.70), this difference was not statistically significant ($F_{1, 30} = 0.66$, $P = 0.43$). Likewise, active players' rating of the extent to which the game held their attention (mean = 4.94, SD = 1.00) was not significantly higher than the rating reported by passive spectators (mean = 4.31, SD = 1.44) ($F_{1, 30} = 2.13$, $P = 0.16$). Thus, any differences observed between the two player conditions on the key outcome variables cannot be attributed to differential levels of positivity or cognitive engagement elicited by the game for players in the two conditions.

Changes in policy rankings

Each participant's posttest ranking of the 14 policy initiatives was subtracted from his or her pretest ranking of the same initiatives to calculate a difference score for each (with positive scores indicating a higher importance ranking at posttest and negative scores indicating a lower ranking at posttest). A one-way analysis of variance revealed marginally significant between-condition differences for three of the initiatives. First, whereas active players, on average, upgraded their ranking of the importance of ''improving postdischarge care'' from pretest to posttest (mean difference = 2.00, SD = 4.06), passive spectators did not (mean difference = –0.69, SD = 3.45) ($F_{1, 30} = 3.75$, $P = 0.06$). Likewise, active players, on average, rated ''access to healthy foods'' as higher in importance after gameplay (mean difference = 2.11, SD = 2.99) to a much greater extent than did passive spectators (mean difference = 0.31, SD = 2.53) ($F_{1, 30} = 3.12$, $P = 0.088$). Finally, whereas active players, on average, downgraded their ranking of ''recruiting additional primary care physicians'' from pretest to posttest (mean difference = –2.33, SD = 4.74), passive players did not (mean difference = 0.23, SD = 3.19) ($F_{1, 30} = 2.85$, $P = 0.10$). It is important to note that all three of these initiatives were ones modeled in the game—and implemented by participants during the course of play. In addition, the fact that any differential patterns of ranking emerged between the two conditions, despite the fact that all participants, active players and passive spectators alike, were exposed to the same game elements, supports the notion that active role-playing and experience-taking in the game was necessary to trigger shifts in policy prioritization.

Changes in attributions for health outcomes

Participants' responses to the pretest and posttest items assessing their attributions for the likely causes of negative health-related (and non–health-related) outcomes were coded by a research assistant who was blinded to participants' assigned condition. The coding scheme categorized participants' attributions as primarily personal (i.e., pointing to dispositional and internal causes for the scenario), primarily situational (i.e., pointing to environmental or systemic causes for the scenario), or neither/ambiguous (for responses without a clear locus of attribution). For example, given the scenario, ''Jamie has lung cancer,'' the attribution ''Jamie

Table 5. Study Variables by Experimental Condition

Measure	*Experimental condition*	
	Active player group (n = 16)	*Passive spectator group (n = 15)*
Game evaluations		
Participants' enjoyment of game	5.11 (1.18)	4.69 (1.70)
Participants' rating of the extent to which the game held their attention	4.94 (1.00)	4.31 (1.44)
Changes in policy importance rankings (pretest–posttest): differences in ranking of importance of		
Improving postdischarge care	+2.00 (4.06)[a]	−0.69 (3.45)[a]
Access to healthy foods	+2.11 (2.99)[a]	+0.31 (2.53)[a]
Recruiting additional primary care physicians	−2.33 (4.74)[a]	+0.23 (3.19)[a]
Proportion of personal (versus situational) attributions for unhealthy diets		
Pretest	0.69 (0.48)	0.67 (0.49)
Posttest	0.22 (0.43)[b]	0.69 (0.47)[b]

Data are mean (standard deviation) values.
[a]Difference in average score in the active player versus passive spectator condition is marginally significant at $P \leq 0.10$.
[b]Difference in average score in the active player versus passive spectator condition is significant at $P \leq 0.05$.

has smoked a pack a day for 30 years'' would be coded as a primarily personal attribution, whereas the attribution ''Jamie has been exposed to polluted air at his factory for 30 years'' would be coded as a primarily situational attribution.

Comparing patterns of attributions between conditions from pretest to posttest revealed a significant shift on one of the four items: the health-related scenario, ''Chris eats fast food for lunch every day.'' In particular, this shift occurred on the attribution offered first by participants (i.e., the one identified by participants as the most likely cause of the scenario). A one-way analysis of variance revealed that in the pretest measurement responses, a higher proportion of attributions given by participants were coded as primarily personal in both the active player condition (mean = 0.69, SD = 0.48) and the passive spectator condition (mean = 0.67, SD = 0.49) ($F_{1,\ 30} = 0.02$, $P = 0.89$). Posttest measures, however, revealed a stark difference: Whereas passive spectators continued to offer personal attributions for Chris's dietary tendencies a majority of the time (mean = 0.69, SD = 0.44), active players gave primarily situational attributions for the same scenario, that is, personal attributions were the clear minority (mean = 0.22, SD = 0.43) ($F_{1,\ 30} = 6.89$, $P = 0.01$). Thus, active players, but not passive spectators, exhibited a clear shift toward more heavily weighting environmental or systemic factors in explaining an individual's unhealthy diet. This result nicely parallels the shift in prioritization of providing higher access to healthy foods reported above for active players' posttest policy initiative rankings.

Discussion

The results of this study suggest that playing ''RePlay Health'' triggered a shift in participants' health-related attitudes and attributions. Participants randomly assigned to experience the game as active players, compared with those assigned to be passive spectators, reported significantly greater movement (from pretest to posttest) in their subjective ranking of three health policies (all of which were ones included in the game) and, furthermore, exhibited a clear tendency toward identifying situational or systemic factors as key contributors to unhealthy behaviors. The between-condition differences attest to the importance of *playing* the game—of taking on the role of characters and, via experience-taking, psychologically merging with those characters' identities, decisions, and outcomes—in producing these shifts. Moreover, the fact that these differences emerged even with a gap of a week between gameplay and posttest measurement suggests that the game has the potential to exert more than just a temporary, short-term impact on its players. These results speak to the potential value of ''RePlay Health'' as a widely applicable tool for enlightening a variety of stakeholders about the day-to-day realities of health and healthcare delivery and stimulating reflection and discussion about the intricacies of health policy and the role of systemic factors in determining health statuses and outcomes.

Although the ''RePlay Health'' game was initially designed to act as a substitute for running the ''ReThink Health Dynamics'' computer simulation among constituents who may not have access to the data, the infrastructure, or the facilitators required to run it, the game could also function as a useful precursor to running the simulation. As the game's strength lies in personalizing the experience of navigating the health system and addressing its problems and limitations, it could potentially be used to motivate on-the-fence groups to bring the simulation into their communities and provide them with greater insight about several of the input and outcome variables modeled by the simulation. In addition, after experiencing the health system's problems personally, many users may be ready and motivated to try to remedy these problems in a proactive, realistic manner. In brief, the ''RePlay Health'' game could function as a supplement to the simulation and inspire real-world individual and collective action. Future empirical work will explore the ability of the game to spur such *behavioral* changes, in addition to the attitudinal and attributional outcomes demonstrated in the present research.

At a broader level, the themes and lessons that emerged during the translation of a computer simulation into experiential active games have broad implications for the design and study of efficacious simulation-based game interventions. Simulations' strengths lie in their ability to quickly and accurately perform intricate calculations with large amounts of data. They are dynamic and respond well to ''what if'' types of interactions. Meanwhile, active games' strengths lie in their ability to give their players embodied, personal experiences through interaction with the game systems, as well as these systems' complexities and dynamics. As the results of the present study demonstrate, active embodiment and role-playing were key to the success of the game at triggering changes in players' attitudes and perceptions. The game provides a qualitatively different experience than the computer simulation, and one that the present work demonstrates can have significant impact on individuals' healthcare-related attitudes and perceptions.

The initial empirical study presented here is intended to serve as a foundational proof-of-concept demonstration of the game's potential impact. Future work will aim to extend these promising findings and, at the same time, address several limitations of the present work. For one, the sample used in the present study was relatively small in size (a ramification of the difficulty the team faced in recruiting participants for an unfunded research project without the ability to offer compensation) and limited in its diversity (with a majority of participants drawn from Dartmouth's premedical and medical programs). The study's sample size likely reduced the statistical power of the analyses reported (with the P value for several of the key findings falling into the marginally significant range of 0.06–0.10), and the limited range of participants (e.g., in terms of age and area of study) may pose a threat to the generalizability of the findings. Even though the game was conceptualized and designed to be effective for a diverse array of constituents and require no prior medical or public health background or knowledge among players, future investigations of the impact of the efficacy of the game should test the generalizability of the reported findings to a variety of demographic groups. In addition, future studies will also seek to provide further evidence of the mechanisms and processes underlying the reported effects—specifically, the experiential or psychological mediators, such as experience-taking and self-other overlap between players and characters—that further explain why active participation in the game, but not passive spectatorship, shifted players' policy prioritizations and health outcome attributions.

Moreover, going forward, the ''RePlay Health'' game itself will likely undergo several new iterations and additions, based on the evaluations and feedback offered by players. For instance, one key element that is currently absent from the game (but plays a key role in the ''ReThink Health Dynamics'' simulation that inspired the game) is the *cost* of implementing policy initiatives. Requiring players to weigh the potential cost (in addition to the benefit) of the policy options in the game will necessarily add complexity to the game's design—and to players' experience—but will more realistically model the individual and collective decision-making processes that constituents and stakeholders must undergo to enact policy reform.

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